Learning local modules in dynamic networks

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Single module identification
Single module identification deals with the identification of one particular component—or module—of the network.

Direct method [1]
For consistent identification of target module $G_{ji}$
- Node signals as predictor inputs $w_i$ and predicted output $w_j$ with $i \in D, j \in Y$;
- $\epsilon(t, \theta) = H(q,\theta)^{-1}[w_i(t) - G(q,\theta)w_j(t) - R_r P_r(t)]$;
- Includes a noise model, indirect method not necessarily need a noise model.

Indirect method [2]
For consistent identification of $G_{ji}$
- External excitation signals as predictor inputs for an open loop MIMO identification problem: $\epsilon(t, \theta) = w_i(t) - \hat{T}(q,\theta)w_j(t)$;
- post-processing: $\hat{G}_{ji} = \hat{T}_{ji} \hat{T}_{ji}^{\dagger}$.

Parallel path and loop condition:
Parallel path passes through predictor input

Handling confounding variables:
Disturbances that affect both inputs and output are handled by adding predictor inputs or predicted outputs.

Generalized method
For consistent identification of target module $G_{ji}$
- Combine elements of direct and indirect methods;
- Both nodes signals and external excitations are used as predictor inputs. Post processing allowed. More flexibility in selecting node signals and relaxed excitation conditions;
- $\epsilon(t, \theta) = H(\theta)^{-1}[w_i(t) - G(\theta)w_j(t) - \hat{T}(\theta)w_k(t)]$.

Algorithmic aspect - kernel based methods [3]
Introduced to handle the computational complexity in large-scale network identification.

References